DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ARITHMETIC.

140. Proposed by ALOIS F. KOVARIK, Instructor in Mathematics and Physics, Decorah Institute, Decorah Iowa.

$\frac{1}{7}=0.\dot{1}4285\dot{7}$; $\frac{1}{14}=0.0\dot{7}14287$; $\frac{1}{21}=0.00\dot{4}7619$. Notice that the sum of the figures in each period is equal to 27. This is not true with $\frac{1}{7^1_2}$, $\frac{1}{7^1_3}$. Is there any general law of which these are special cases, and if so, what is it?

Solution by J. SCHEFFER, A. M., Hagerstown, Md.

When the *period* of a circulating decimal fraction consists of an *even* number of figures, the second half of that period can be found by subtracting each figure of the first half from the figure 9. In this case the sum of the figures constituting a period is always divisible by 9, because we have as many 9's as there are figures in a half-period. Should the half-period have 3 or 6 or 9 or 12, etc., figures, then the sum of the figures in the period will be divisible by 27, and only then. The period of $\frac{1}{7^1_2}$ is only 8 and cannot be divisible by 27. The period of $\frac{1}{7^1_3}$ consists of eight figures of which the first four are 0, 1, 3, 6, consequently the last four are 9, 8, 6, 3, and the sum of the figures $4\times 9=36$.

141. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pa.

If the alloy in a half-dollar be 1-13th of the mass, and the coin be worth a cent if it be all alloy, what should be the exact value of the coin if it be all pure silver?

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics.The Temple College, Philadelphia, Pa.; P. S. BERG, Larimore, N. D.; J. SCHEFFER, A. M., Hagerstown, Md.; and HARVEY M. DAVIS, Brown University, Providence, R. I.

Suppose the half-dollar worth 50 cents.

Then since alloy is worth $\frac{1}{13}$ of a cent, $\frac{12}{13}$ of the mass=silver, is worth $49\frac{12}{13}$ cents.

$\frac{1}{13}$ silver is worth $\frac{1}{12}$ of $49\frac{12}{13}$.

$\frac{13}{13}$ silver is worth $\frac{13}{12}$ of $49\frac{12}{13}$ cents$=54\frac{1}{12}$ cents.

GEOMETRY.

49. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics at Springfield, Mo.

Given a conic and two circumscribing triangles of the conic; prove that the six vertices of the triangles are con-conic.

Solution by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio University, Athens, O.

This is most neatly solved, perhaps, by the theory of projection.

Projecting two of the vertices of the first triangle into the circular points